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RUNNING TITLE

Effects of the interRAI PC in nursing homes

AUTHORS

1. Kirsten Hermans, MSPsy, Junior Researcher (corresponding author)[a]

   E-mail: kirsten.hermans@kuleuven.be

   Tel.: +32(0)16 37 34 07

   Fax: +32(0)16 33 69 22

2. Johanna de Almeida Mello, MSEcon, Junior Researcher[a]
3. Nele Spruytte[a], MSPsych, PhD, Senior Researcher[a]
4. Joachim Cohen, MSSoc, PhD, Professor[b]
5. Chantal Van Audenhove, MSPsy, PhD, Professor[a]
6. Anja Declercq, MSSoc, MsEcon, PhD, Professor[a] (alternate corresponding author)

   E-mail: anja.declercq@kuleuven.be

   Tel.: +32(0)16 37 34 31

   Fax: +32(0)16 33 69 22

[a]KU Leuven – University of Leuven, LUCAS, Center for Care Research and Consultancy, Minderbroedersstraat 8 / 5310 B-3000 Leuven

[b]End-of-Life Care Research Group, Vrije Universiteit Brussel (VUB) & Ghent University, Laarbeeklaan 103 B-1090 Brussels

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ABSTRACT AND KEYWORDS

Objectives: This study aims to evaluate whether using the interRAI Palliative Care instrument (the interRAI PC) in nursing homes is associated with reduced needs and symptoms in residents nearing the end of their lives.

Methods: A quasi-experimental pretest-posttest study using the Palliative care Outcome Scales (POS) was conducted to compare needs and symptoms of residents nearing the end of their lives in control and intervention nursing homes. Care professionals of the intervention nursing homes filled out the interRAI PC during one year for all residents aged 65 years and over, nearing the end of their lives. This intervention was not implemented in the control nursing homes.

Results: At baseline, POS-scores in the intervention nursing homes were lower (more favourable) than in the control nursing homes on the items 'pain', 'other symptoms', 'family anxiety' and the total POS-score. Posttest POS-scores for 'wasted time' were higher (less favourable) than pretest scores in the intervention nursing homes. In the intervention nursing homes where care professionals did not have prior experience with the interRAI Long-term Care Facilities instrument (n=8/15), total POS-scores were lower (more favourable) at posttest.

Significance of results: One year after introducing the interRAI PC, no reduced residents' needs and symptoms were detected in the intervention nursing homes. However, reduced needs and symptoms were found in the subgroup of intervention nursing homes without prior experience with the interRAI Long-term Care Facilities instrument. This may suggest that the use of an interRAI instrument rather than the use of the interRAI PC specifically can improve care. Future research should aim at replicating this research in a long-term design in order to evaluate the effect of integrating the use of the interRAI PC in the day-to-day practices of the nursing homes.

Keywords: the interRAI Palliative Care instrument, Palliative Care, Comprehensive Assessment, Nursing homes, Older Adults.

INTRODUCTION

Palliative care in nursing homes

As the population is ageing rapidly, the number of people staying in nursing homes has increased (WHO, 2011). Since many nursing home residents are facing chronic (progressive) diseases, such as dementia, hypertension, and diabetes, they are more vulnerable to a decline in health status and death (van Dijk et al., 2005). As a result, the importance of nursing homes as locations for palliative care increases (Ersek and Carpenter, 2013).

Palliative care aims "to improve the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by an early identification, impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual" (WHO, 2002). This definition emphasizes the need to adopt a holistic model of assessment and care (Rosser & Walsh, 2014), which highlights the concept of 'total pain'. Total pain not merely looks at physical components of pain but also at emotional, cultural, psychological, social, spiritual and existential components (Bendelow & Williams, 1995). Given the diversity in individual suffering, it is important for care professionals to understand and address the different palliative care needs (Goldstein & Morrison, 2012). However, the identification of these needs in nursing homes is challenging, due to a lack of care professional knowledge on palliative care practices, low staffing levels, a lack of available time for the residents, a lack of adequate screening, etc. (Wowchuk et al., 2007). Palliative care needs and symptoms are therefore often over-or underestimated and poorly addressed, especially in residents with dementia (Hermans et al., 2016;). Research shows that a comprehensive assessment tool can support the evaluation and identification of the residents' needs in palliative care practice (McIlfatrick & Hasson, 2014).

The interRAI Palliative Care instrument and the BelRAI web application

In 2003, the multinational research consortium interRAI developed the interRAI Palliative Care instrument (the interRAI PC) in order to provide standardized, comprehensive information on the different needs, strengths and preferences of adults receiving palliative care (Hirdes et al., 2008; Smith et al., 2010). The instrument was designed as part of the interRAI Suite of Instruments (e.g. interRAI Home Care, interRAI Acute Care, interRAI

Long-term Care Facilities) (interRAI.org). The 74-item instrument consists of 17 sections, covering 8 domains: symptoms or conditions, cognitive competency and communication, mood, functional status, preferences, social relations, spirituality, services and treatments (Steel et al., 2003). The inter-rater reliability was found to be .77 in all domains (average Kappa = .83) (Hirdes et al., 2008). The Kappa value was .80 or higher in more than half of the questions (Steel et al., 2003). The interRAI PC is the most comprehensive assessment that has been validated for nursing home residents with palliative care needs (Hermans et al., 2014).

In Belgium, the interRAI instruments are completed on the secured, online web application BelRAI (belrai.org). This web application enables a multidisciplinary completion of the instruments and supports the exchange of client data between health care settings, thereby improving the continuity of care (Vanneste & Declercq, 2014; Hermans, 2014). In 2012, the interRAI PC instrument was implemented on the BelRAI web application (Hermans et al., 2014). The outcomes of the interRAI PC are Client Assessment Protocols (CAPs) and Scales. CAPs alert to specific problems and inform on the risk of their appearance or the potential for improvement. Every CAP is linked to guidelines which inform care professionals on how to approach problems in order to resolve them, reduce the risk of deterioration or increase the opportunity to improve or maintain function (Carpenter & Hirdes, 2013). The scales of the interRAI instruments are coherent calculations of client characteristics and are conform to internationally validated scales (Declercq et al., 2009;). The standardized overview of CAPs and scales of the interRAI PC can be used to support care planning and facilitate the dialogue with clients and their family (Steel et al., 2003; Bernabei, 2008; Hermans et al., 2016). Research shows that data gathered from the interRAI PC may improve understanding of palliative care clients. Integrating the interRAI PC outcomes into the care planning process may allow for a higher quality of care since person-specific needs would be addressed better (Freeman et al, 2014). However, to our knowledge, no studies have yet been conducted to evaluate whether needs and symptoms of people potentially requiring palliative care are better met when using the interRAI PC.

Research aims

The main aim of this study is to evaluate whether palliative care needs of nursing home residents are better met and whether symptoms associated with the palliative care situation are reduced, after using the interRAI PC during one year. In 2006, the BelRAI project was commissioned by the Federal Public Service, Health, Food Chain Safety and Environment in order to test the feasibility of the BelRAI web application and the use of the

interRAI instruments in Belgium (Declercq et al., 2009). During this project, about 20 Belgian nursing homes received a training on the BelRAI web application and the interRAI Long-term Care Facilities (interRAI LTCF). Until now, several nursing homes still use the interRAI LTCF in day-to day practices to assess and tackle needs of their residents. The secondary aim of our study is therefore to evaluate whether or not prior experience with the interRAI influences the effect of interRAI PC. Because several Belgian nursing homes already use the interRAI LTCF, we hypothesise a smaller effect of the interRAI PC in these nursing homes than in the nursing homes that were not using the interRAI LTFC (Dimitrov & Rumrill, 2003).

METHODS

Design

This study has a quasi-experimental pretest-posttest design and is part of a complex intervention to evaluate the use of the interRAI PC in nursing homes. A protocol of this study was published elsewhere (Hermans et al., 2014). The SQUIRE 2.0 guidelines (Standards for QUality Improvement Reporting Excellence) were used for reporting.

Setting

Calls for participation to the intervention group were sent out by all four umbrella organizations of nursing homes in Flanders (Dutch speaking part of Belgium), and at a national conference for nursing home staff. Care professionals of 15 nursing homes agreed to participate to the study and implement the interRAI PC instrument in their nursing home (intervention). Based on the list of nursing homes in Flanders from the National Institute for Health and Disability Insurance (NIHDI), 15 other nursing homes were matched to these intervention nursing homes in terms of facility size and geographic region and were contacted for participation in the control group.

Eligibility

Of the 15 control and 15 intervention nursing homes, residents aged 65 and over who were anticipated to be in the last year of their lives were included in the study. The latter identification was based on the 'surprise question' (Would you be surprised if this person was to die within 6 to 12 months?) (Hubbard, 2011). Research shows the 'surprise question' to be a feasible, effective and simple screening tool to identify people with

greatly increased risk of mortality in the next year (Moss et al., 2010). For this study, the answers on the surprise question were discussed for every resident of the nursing home during multidisciplinary team meetings (MDT) in the nursing homes.

Data collection

Pretest: At baseline, care professionals of the multidisciplinary nursing home staff of 15 intervention and 15 control nursing homes filled out the Palliative care Outcome Scale (POS) for all residents identified as eligible. The POS is a ten-item multidimensional scale that covers physical, psychological, emotional, spiritual, practical and informational domains of life (Cicely Saunders Institute, 2012). The POS can be used to evaluate palliative care needs and symptoms of people with and without dementia (Brandt et al., 2005). Based on a validation study in specialist palliative care settings throughout the UK, the POS was found to be internally consistent (patient-version α=.70, staff-version α=.65). Furthermore, the POS shows moderate to good construct validity (Spearman rho=.43 to .80), and good test-retest reliability for 7 of 10 items (Hearn & Higginson, 1999). The first eight items of the POS are scored on a five-point Likert scale ranging from 0 (no problem) to 4 (overwhelming problem). Items 9 (wasted time) and 10 (personal affairs) are scored on a three-point scale: 0 (good), 2 (moderate) and 4 (bad). Individual POS item scores of 0 or 1 require less clinical attention than items that score two, three or four (Cicely Saunders Institute, 2012). The POS has already been used in several studies with a pretest-posttest design in order to evaluate differences in palliative care needs after implementing an intervention (Bajwah et al., 2015).

There are two versions of the POS: the POS-patient version is to be filled out by the patient and the POS-staff version is to be filled out by the staff. Agreement between both versions was found to be acceptable for eight out of ten items (Hearn & Higginson, 1999). It is not feasible to obtain the POS-patient version from all nursing home residents. Especially for people with dementia, filling out a structured questionnaire is not always possible. Since this study includes residents with and without dementia, the POS-staff version was used for all residents for reasons of comparability. Nurses and nursing assistants were informed on the use of the POS and received a POS-manual during an introductory meeting. Depending on the degree of cognitive impairment of the nursing home resident, the POS-staff version was completed individually by nurses and nursing assistants who knew the resident well or in consultation with the nursing home resident or a relative of the resident.

Intervention: Care professionals of the intervention nursing homes received a training on the use of the interRAI PC and the BelRAI web application. During one year, these care professionals filled out the interRAI PC every three months for all residents identified as eligible. Based on the CAPs and scales that resulted from the interRAI PC assessment and the accompanying manuals, care professionals were able to evaluate, adapt and design individual care plans. All steps of the intervention were described in the study protocol (Hermans et al., 2014). The control nursing homes did not complete the interRAI PC and provided care as usual.

Posttest: At posttest, care professionals of both intervention and control nursing homes again completed the POS for all nursing home residents anticipated to be in the last year of life in order to evaluate whether palliative care needs and symptoms were reduced after using the interRAI PC.

Data analyses

Analyses were conducted in SPSS and STATA 11.2. We respectively used the Wilcoxon Mann-Whitney-U test and the Wilcoxon signed ranks test in order to compare the following data:

Primary outcomes

- Pretest data of the intervention and control nursing homes.
- Pretest and posttest data of the control nursing homes.
- Pretest and posttest data of the intervention nursing homes.
- Posttest data of the control and intervention nursing homes.

Secondary outcomes

- Pretest and posttest data of the intervention nursing homes that were already working with interRAI the interRAI Long-term Care Facilities instrument.
- Pretest and posttest data of the intervention nursing homes that were not working with the interRAI Long-term Care Facilities instrument.

Generalized Linear Mixed Models (GLMM) were used to adjust for clustering by nursing homes. GLMMs combine the properties of two statistical frameworks: *linear mixed models*, which incorporate random effects and *generalized linear models*, which handle non-normal data by using link functions and exponential family (e.g. normal, Poisson or binomial distributions). GLMMs are the best tool for analysing non-normal data since they provide a more flexible approach (Bolker et al., 2008). They provide a broad range of models for the

analysis of grouped data.. For this study, two tests were performed: a Linear Model to test for fixed-, between-, and random-effects adjusted for the cluster and a Generalized Linear Mixed Effect Regression. Both tests yielded the same results.

Ethics statement

Approval to conduct this research was granted by the Belgian Commission for the Protection of Privacy (BCPP) and the UZ Leuven Medical Ethics Committee (file number B322201421986). All nursing home residents with palliative care needs or their representatives were asked to sign an informed consent agreement. Refusing to participate did not affect the care services offered to the resident. When residents or their representatives decided to participate, they could withdraw their consent at any time. A formal procedure was undertaken to enable caregivers to fill out the interRAI PC on a secured online web application (belrai.org).

RESULTS

Setting

Care professionals of 15 nursing homes agreed to participate to the study and implement the interRAI PC instrument in their nursing home (intervention nursing homes). Of the 15 intervention nursing homes, all participated in the pretest and 12 in the posttest. Four intervention nursing homes were already working with the interRAI LTCF since 2006. Eight nursing homes did not have prior experience with the interRAI LTCF.

Of the 15 matching control nursing homes who participated in the pretest, 9 did so in the posttest. Drop-out was due to the following reasons: a lack of time to complete the interRAI PC, a lack of staff, discharge of the contact persons, renovation of the nursing home, etc.

Nursing home residents

In total, 429 nursing home residents were identified as eligible and signed an informed consent agreement. The pretest consisted of 273 nursing home residents: 133 in the intervention group and 140 in the control group.

The posttest consisted of 156 nursing home residents of whom 83 were included in the intervention condition and 73 in the control group. Specific data on the characteristics of the residents can be found in appendix.

Since the surprise question was used to identify residents with palliative care needs, most residents that were included in the pretest had died before the posttest was conducted. The posttest sample thus consisted of different subjects than the pretest sample.

Pretest and posttest outcomes (Table 1 and 2)

At baseline, significant differences were found between POS scores of the 15 control and intervention nursing homes on the items 'pain' (Coef.= -0.492 ; 95% CI= -0.90,-0.08; P=0.019), 'other symptoms' (Coef.= -0.577; 95% CI= -0.95, -0.21; P=0.002), 'family anxiety'(Coef.= -1.055; 95% CI= -1.58, -0.52; P<0.001) and the total POS score (Coef.= -2.66; 95% CI= -4.76, -0.56; P=0.013) (table 1). No differences were found between posttest POS scores of the control and the intervention nursing homes (table 1).

We found no significant differences between pretest and posttest POS scores of the control nursing homes (N=9) (table 2). Posttest POS-scores in the intervention nursing homes (N=12) were significantly higher on item 9 'wasted time' (Coef.= .14; 95% CI= .05, -.23; P=0.002), indicating that more time was wasted on appointments related to the care for the resident (e.g. waiting for transport, repeated examinations, etc.). No other significant differences between pretest and posttest POS scores of the intervention nursing homes were found (table 2).

Secondary outcomes (table 3)

No significant differences were identified between pretest and posttest POS scores of the intervention nursing homes that were already working with the interRAI LTCF (N=4).

Total POS scores in the intervention nursing homes where care professionals did not have prior experience with the completion of the interRAI instruments (N=8) were significantly lower in the posttest (Coef.= -2.01; 95% CI= -3.89, -.14; P=.036), even after adjusting for the clustering (table 3).

Wilcoxon Mann-Whitney U test results were consistent with the results that were retrieved from the GLMM analyses.

DISCUSSION

This study found the use of the interRAI PC in nursing homes during one year not to be associated with reduced needs and symptoms of residents anticipated to be in their last year of lives. Care professionals of the nursing

homes using the instrument even indicated more time wasted on appointments concerning the care for the resident (e.g. waiting for transport, repeated examinations, etc.) than prior to implementation of the instrument. There are a number of reasons for the negative results regarding care professionals experiencing a waste of time after implementing the interRAI PC. Research shows that filling out the interRAI instruments is an extensive, laborious and time-consuming process. Care professionals do not always have sufficient time to complete the instruments, especially not in nursing home where there is a high workload (Hermans et al., 2016; Devriendt et al., 2013; Vanneste & Declercq, 2014). A study in Belgian nursing homes shows that it takes about one year to integrate the use of the interRAI PC in the day-to-day practices of the nursing homes (Hermans et al., 2016). After this period, the perceived and actual time-waste may reduce. The implementation of complex interventions requires time and practice as several elements need to be taken into account. What works in one setting may not be as effective or may be harmful in another setting (National Institute for Health and Clinical Excellence, 2007). Moreover, for this study evaluating the interRAI PC a number of additional burdens may have been imposed that would not apply in real-life implementation and which may have increased the perceived time waste. For instance, as user involvement is essential in implementation research, key users had to be involved in all stages of the process and the evaluation of the intervention (Craig et al., 2000). Also, all nursing home residents with palliative care needs or their representatives needed to be asked for an informed consent agreement which would not be the case in real life implementation.

Why no reduced residents' needs and symptoms were detected in the posttest also warrants further discussion. It took about a year to implement the interRAI PC and the BelRAI web application in the nursing homes (Hermans et al., 2016) and some nursing homes did not have sufficient time to discuss and work with the interRAI PC results (Client Assessment Protocols and Scales) next to merely registering. Hence, they did not use the results to develop, evaluate and adjust care plans. Ideally, clinicians need to react when Client Assessment Protocols are triggered by a collaborative decision-making process deciding whether or not the triggered issues should be addressed in a plan of care (Freeman et al. 2014). This would suggest that our study was only able to capture a preliminary effect of the interRAI PC instrument and future research should evaluate in a longer-term design whether effective and appropriate use of the interRAI PC CAPs and Scales is associated with reduced needs and symptoms of residents receiving palliative care.

Interestingly, we did find reduced unmet needs and symptoms after the intervention in those nursing homes that had no prior experience with the use of the interRAI LTCF instrument, but did not find this effect in the

nursing homes that had prior experience. Our hypothesis about a ceiling effect seems to be confirmed. An explanation could be that using an interRAI instrument reduces residents' needs, independent of what specific interRAI instrument is being used, because it provides an overall picture of the person's needs and leads to a better observation of the nursing home residents and care professionals act upon the clients' needs in order to fulfil these needs (Devriendt et al., 2016; Hermans et al., 2016; Vanneste & Declercq, 2014). This may suggest the usefulness of adding specific palliative care items as a supplement to the other interRAI instruments rather than working with a separate instrument for use in palliative care situations.

Strengths and limitations

This is the first study to evaluate whether the use of the interRAI Palliative Care instrument is associated with reduced palliative care needs in the nursing home setting. The study has a pretest-posttest design with quasi-random assignment to the control and the intervention groups. The 15 control nursing homes matched the intervention nursing homes regarding to the number of residents and the geographic region. Another strength of the study is the use of Generalized Linear Mixed Models (GLMM) to adjust for clustering by nursing homes.

However, limitations of the study also need to be acknowledged. First of all, sampling bias might have occurred as it was not possible to conduct a randomized controlled trial, due to ethical and practical reasons. Because of the strong commitment requirements, all nursing homes which volunteered to participate were included. Furthermore, it was impossible to refuse care professionals to fill out the interRAI PC since the instrument is accessible for all nursing homes through the online web application BelRAI. All volunteering nursing homes were thus included in the study. Sampling bias might also have occurred as, in spite of the matching of control and intervention nursing homes, intervention nursing homes scored better from baseline on. This might be due to the fact that these nursing homes are more innovative in general and search for methods to improve the quality of care. Finally, as the population in the pretest was different from the population in the posttest, some limitations were imposed on the analyses.

Conclusion

After completing the interRAI PC during one year, no reduced residents' needs and symptoms were detected in the intervention nursing homes. We did find an effect in the subgroup of intervention nursing homes where care professionals did not have prior experience with the interRAI Long-term Care Facilities: there were fewer

needs and symptoms after using the interRAI PC instrument during one year. Future research should aim to replicate this study in a longer-term design in order to evaluate whether integrating the use of the interRAI PC in the day-to-day practices of the nursing homes supports regular observation of the resident and hence early detection of needs and symptoms.

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We declare that there are no conflicts of interest.

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Table 1. Control nursing homes and intervention nursing homes at baseline and at posttest

POS items	Control nursing homes and intervention nursing homes at baseline (N=15)						Control nursing homes (N=9) and intervention nursing homes (N=12) at posttest					
	Control nursing homes (n=140)		Intervention nursing homes (n=133)		Cluster-adjusted[a]		Control nursing homes (n=87)		Intervention nursing homes (n=83)		Cluster-adjusted[a]	
	x̄ [SD]	M	x̄ [SD]	M	Coef. [IC]	P	x̄ [SD]	M	x̄ [SD]	M	Coef. [IC]	P
Pain	1.6 [1.2]	2.0	1.1 [1.2]	0.5	-0.492 [-0.90;0.08]	**0.019***	1.2 [1.1]	1.0	1.1 [1.1]	1.0	-0.30 [-0.82;0.22]	0.253
Other symptoms	1.4 [1.1]	1.0	0.9 [1.2]	0.0	-0.577 [-0.95;-0.21]	0.002	1.0 [0.0]	0.0	0.7 [1.1]	0.0	-0.51 [-1.05;0.03]	0.066
Patient anxiety	1.5 [1.2]	2.0	1.3 [1.3]	1.0	-0.271 [-0.73;0.19]	0.245	1.4 [1.2]	1.5	1.3 [1.3]	1.0	-0.10 [-0.68;0.48]	0.733
Family anxiety	2.1 [1.3]	2.0	1.1 [1.3]	1.0	-1.055 [-1.58;-0.52]	**<0.001***	1.6 [1.2]	2.0	1.2 [1.3]	1.0	-0.52 [-1.34;0.30]	0.211
Information	0.9 [1.4]	0.0	0.9 [1.5]	1.0	-0.055 [-0.54;0.43]	0.825	0.6 [1.2]	0.0	0.9 [1.4]	0.0	0.12 [-0.67;0.92]	0.758
Support	1.7 [1.4]	1.0	1.9 [1.5]	0.0	0.183 [-0.31;0.68]	0.471	1.5 [1.6]	1.0	1.7 [1.5]	1.0	0.03 [-0.91;0.84]	0.944
Life worthwhile	1.9 [1.2]	2.0	1.9 [1.3]	2.0	0.00 [-0.36;0.36]	0.997	1.8 [1.3]	2.0	1.9 [1.3]	2.0	-0.23 [-1.06;0.59]	0.581
Self-worth	2.0 [1.0]	2.0	1.8 [1.2]	2.0	-0.23 [-0.57;0.11]	0.184	2.0 [1.3]	2.0	1.9 [1.2]	2.0	-0.36 [1.13;0.42]	0.366
Wasted time	0.1 [0.4]	0.0	0.0 [0.2]	0.0	-0.08 [-0.16;0.00]	0.056	0.1 [0.3]	0.0	0.1 [0.0]	0.0	0.07 [-0.10;0.24]	0.404
Personal affairs	0.2 [0.8]	0.0	0.4 [0.8]	0.0	0.076 [-0.20;0.35]	0.594	0.4 [1.0]	0.0	0.2 [0.7]	0.0	-0.24 [-0.60;0.12]	0.188
Total POS Score	13.4 [5.0]	13.0	11.1 [5.2]	11.0	-2.66 [-4.76;-0.56]	**0.013***	11.5 [6.0]	11.0	10.8 [5.9]	11.0	-3.08 [-7.91;1.75]	0.212

[a]By GLMM (controlled for gender, age, dementia diagnosis)

Table 2. Comparison of pretest and posttest POS scores in the control nursing homes and comparison of pretest and posttest POS scores in the intervention nursing homes

POS items	Control nursing homes (N=9)						Intervention nursing homes (N=12)					
	Pretest (n=104)		Posttest (n=87)		Cluster-adjusted		Pretest (n=109)		Posttest (n=83)		Cluster-adjusted[a]	
	x̄[SD]	M	x̄ [SD]	M	Coef. [IC]	P	x̄ [SD]	M	x̄ [SD]	M	Coef. [IC]	P
Pain	1.5 [1.0]	2.0	1.2 [1.1]	1.0	-0.23 [-0.56;0.09]	0.161	1.1 [1.2]	0.5	1.1 [1.1]	1.0	-0.09 [-0.46;0.27]	0.610
Other symptoms	1.4 [1.2]	1.0	2.0 [1.2]	0.0	-0.14 [-0.51;0.23]	0.453	0.9 [1.2]	0.0	0.7 [1.1]	0.0	-0.16 [-0.50;0.19]	0.378
Patient anxiety	1.5 [1.2]	1.0	1.5 [1.2]	2.0	0.14 [-0.26;0.54]	0.503	1.3 [1.3]	1.0	1.3 [1.3]	1.0	-0.02 [-.038;0.41]	0.939
Family anxiety	2.0 [1.2]	2.0	1.6 [1.2]	2.0	-0.32 [-0.66;0.03]	0.071	1.1 [1.3]	1.0	1.2 [1.3]	1.0	-0.12 [-0.52;0.28]	0.555
Information	1.0 [1.4]	0.0	0.6 [1.2]	0.0	-0.38 [-0.80;0.04]	0.075	0.9 [1.5]	0.0	0.9 [1.4]	0.0	-0.38 [-0.83;0.07]	0.099
Support	1.8 [1.3]	2.0	1.5 [1.6]	1.0	-0.09 [-0.51;0.32]	0.657	1.9 [1.5]	2.0	1.7 [1.5]	1.0	-0.42 [-0.89;0.06]	0.085
Life worthwhile	1.9 [1.2]	2.0	1.8 [1.3]	2.0	0.05 [-0.31;0.41]	0.796	1.9 [1.3]	2.0	1.9 [1.2]	2.0	-0.23 [-0.62;0.15]	0.238
Self-worth	2.1 [1.0]	2.0	2.0 [1.3]	2.0	-0.04 [-0.36;0.27]	0.782	1.8 [1.2]	2.0	1.9 [1.2]	2.0	-0.14 [-0.48;0.20]	0.410
Wasted time	0.1 [0.4]	0.0	0.2 [0.3]	0.0	-0.01 [-0.12;0.09]	0.810	0.0 [0.2]	0.0	0.1 [0.5]	0.0	0.15 [0.05;0.25]	**0.004***
Personal affairs	0.2 [0.6]	0.0	0.4 [1.0]	0.0	0.17 [-0.10;0.45]	0.219	0.4 [0.8]	0.0	0.2 [0.8]	0.0	-0.06 [-0.29;0.19]	0.704
Total POS Score	13.4 [5.0]	13.0	11.5 [6.0]	11.0	-0.68 [-2.27;0.91]	0.399	11.3 [5.4]	11.0	10.8 [6.0]	11.0	-1.39 [-3.03;0.26]	0.099

[a]By GLMM (controlled for gender, age, dementia diagnosis)

Table 3. Comparison of pretest and posttest POS scores in the intervention nursing homes

POS items	Intervention nursing homes that were already working with the interRAI LTCF (N=4)						Intervention nursing homes without prior experience with the interRAI LTCF (N=8)					
	Pretest (n=55)		Posttest (n=35)		Cluster-adjusted[a]		Pretest (n=81)		Posttest (n=48)		Cluster-adjusted[a]	
	x̄ [SD]	M	x̄ [SD]	M	Coef. [IC]	P	x̄ [SD]	M	x̄ [SD]	M	Coef. [IC]	P
Pain	1.3 [1.2]	1.0	1.2 [1.1]	1.0	-0.06 [-0.59;0.47]	0.825	2.0 [1.2]	0.0	1.1 [1.1]	1.0	-0.14 [-0.62;0.33]	0.560
Other symptoms	1.0 [1.1]	1.0	0.8 [1.2]	0.0	-0.01 [-0.58;0.56]	0.977	0.8 [1.1]	0.0	0.6 [1.0]	0.0	-0.25 [-0.64;0.15]	0.288
Patient anxiety	1.2 [1.1]	1.0	1.6 [1.2]	2.0	0.43 [-0.12;0.97]	0.127	1.4 [1.4]	1.0	1.1 [1.3]	1.0	-0.34 [-0.87;0.19]	0.209
Family anxiety	1.3 [1.3]	1.0	1.3 [1.4]	1.0	-0.07 [-0.56;0.69]	0.832	1.0 [1.3]	0.0	1.2 [1.2]	1.0	-0.29 [-0.76;0.19]	0.237
Information	1.3 [1.6]	1.0	1.3 [1.6]	1.0	-0.53 [-1.28;0.22]	0.165	0.7 [1.4]	0.0	0.5 [1.1]	0.0	-0.32 [-0.82;0.17]	0.203
Support	2.2 [1.3]	2.0	2.0 [1.6]	2.0	-0.27 [-0.95;0.42]	0.441	1.8 [1.6]	1.0	1.4 [1.5]	1.0	-0.43 [-1.02;0.15]	0.149
Life worthwhile	2.0 [1.2]	2.0	2.2 [1.1]	2.0	0.00 [-0.53;0.53]	1.000	1.9 [1.3]	2.0	1.7 [1.3]	1.0	-0.47 [-0.99;0.52]	0.078
Self-worth	2.1 [1.2]	2.0	2.0 [1.0]	2.0	-0.08 [-0.55;0.39]	0.737	1.6 [1.1]	1.0	1.8 [1.3]	1.0	-0.19 [-0.66;0.28]	0.437
Wasted time	0.1 [0.2]	0.0	0.2 [0.5]	0.0	0.14 [-0.02;0.31]	0.091	0.0 [0.2]	0.0	0.1 [0.4]	0.0	0.12 [-0.00;0.24]	**0.047***
Personal affairs	0.4 [1.0]	0.0	0.2 [0.8]	0.0	-0.06 [-0.47;0.36]	0.789	0.3 [0.8]	0.0	0.2 [0.7]	0.0	-0.10 [-0.39;0.20]	0.521
Total POS Score	12.7 [5.0]	12.0	12.2 [5.0]	12.0	-0.31 [-2.67;2.04]	0.793	10.2 [5.2]	10.0	9.5 [6.2]	9.0	-2.46 [-4.65;-0.27]	**0.036***

[a]By GLMM (controlled for gender, age, dementia diagnosis)

Appendix. Characteristics of the nursing home residents

	12 intervention nursing homes			4 intervention nursing homes already working with the interRAI LTCF			8 intervention nursing homes without prior experience with the interRAI LTCF			9 control and 12 intervention nursing homes at posttest		
Characteristics	**Pretest (n=109)**	**Posttest (n=83)**	**P[a]**	**Pretest (n=55)**	**Posttest (n=35)**	**P[a]**	**Pretest (n=81)**	**Posttest (n=48)**	**P[a]**	**Control (n=87)**	**Intervention (n=83)**	**P[a]**
Years (mean ±SD)	87.9 (6.3)	86.5 (8.0)	0.579	87.0 (6.3)	86.7 (8.0)	0.871	86.6 (6.3)	86.3 (8.0)	0.759	87.62 (7.0)	86.5 (8.0)	0.661
Gender, n (%)			0.463			0.114			0.991			0.131
Women	71 (65)	56 (67)		26 (47)	28 (80)		40 (49)	28 (58)		42 (48)	56 (67)	
Men	36 (33)	22 (27)		15 (27)	7 (20)		21 (26)	16 (33)		28 (32)	22 (27)	
Missing	2 (12)	5 (6)		14 (26)	0 (0)		20 (25)	4 (9)		17 (20)	5 (6)	
Dementia, n (%)			0.306			0.249			0.616			0.156
Yes	60 (45)	49 (59)		21 (38)	23 (66)		35 (43)	28 (58)		52 (60)	49 (59)	
No	47 (35)	27 (33)		19 (35)	12 (34)		26 (32)	16 (33)		24 (40)	27 (33)	

By Wilcoxon Mann Whitney U test